MISB MOTION IMAGERY STANDARDS BOARD	MISB ST 0902.8
STANDARD	
Motion Imagery Sensor Minimum Metadata Set	**1 November 2018**

1 Scope

This standard defines the Motion Imagery Sensor Minimum Metadata Set (MISMMS), which enables the basic capabilities of Situational Awareness, Discovery & Retrieval, and Cross-Domain Dissemination. In addition, the standard provides direction on the encoding of the MISMMS for low-bitrate to high-bitrate scenarios to support a transition path from analog systems towards all digital Motion Imagery Systems.

2 References

[1] MISB ST 0601.14 UAS Datalink Local Set, Nov 2018.

[2] MISB MISP-2019.1 Motion Imagery Standards Profile, Nov 2018.

[3] MISB ST 0107.3 KLV Metadata in Motion Imagery, Nov 2018.

[4] MISB ST 0102.12 Security Metadata Universal and Local Sets for Motion Imagery Data, Jun 2017.

[5] MISB ST 1204.1 Motion Imagery Identification System (MIIS) Core Identifier, Oct 2013.

3 Acronyms

BER	Basic Encoding Rules
D&R	Discovery and Retrieval
FoV	Field of View
HAE	Height above Ellipsoid
ISR	Intelligence, Surveillance and Reconnaissance
KLV	Key Length Value
LS	Local Set
MFG	Metadata Focus Group
MIIS	Motion Imagery Identification System
MISB	Motion Imagery Standards Board
MISMMS	Motion Imagery Sensor Minimum Metadata Set
MISP	Motion Imagery Standards Profile

MSL	Mean Sea Level
NATO	North Atlantic Treaty Organization
NGA	National Geospatial-Intelligence Agency
NIAT	NGA Interoperability Action Team
NTB	NITF Technical Board
SA	Situational Awareness
STANAG	Standardization Agreement
TLV	Tag Length Value
UL	Universal Label
USCENTCOM	U.S. Central Command
ZLI	Zero-Length Item (See MISB ST 0601 [1])

4 Revision History

Revision	Date	Summary of Changes
ST 0902.8	11/01/2018	• Added Requirement -05 • Deprecated Requirement -02 as it is a definition • Changed “element” to “item” consistent with SMPTE usage

5 Introduction, Intent, and General Implementation Rules

The MISMMS consists of metadata items from MISB ST 0601 [1], which enable the baseline functionality required for Discovery & Retrieval / Cross-Domain Dissemination of source imagery and the Situational Awareness Product for ISR mission accomplishment as defined in the MISP [2].

The initial MISMMS was developed jointly by the Motion Imagery Standards Board (MISB), the NITFS Technical Board (NTB), the NGA Interoperability Action Team (NIAT), and the Metadata Focus Group (MFG) with additional subject matter expert input from U.S. Central Command (USCENTCOM), NATO Standardization Agreement (STANAG) 4586, and the Unmanned Systems community.

As Motion Imagery systems begin to migrate to all-digital architectures, some systems in transition still require the consistent preservation of certain analog system characteristics. This standard identifies how to encode the source-derived metadata from a Motion Imagery sensor into a MISB KLV metadata set.

6 Motion Imagery Sensor Minimum Metadata Set

The MISMMS is a Local Set profile of MISB ST 0601 with all items mandatory unless conditionally dependent. Thus, it uses the ST 0601 Universal Label.

The KLV Universal Label for the MISMMS is defined in MISB ST 0601 [1] as:

06.0E.2B.34.02.0B.01.01.0E.01.03.01.01.00.00.00 (CRC 56773)

Requirement(s)	
ST 0902.3-01	All metadata shall be expressed in accordance with MISB ST 0107 [3].
ST 0902.3-03	The items of the MISMMS as defined in MISB ST 0902 Table 1 shall be populated in accordance with MISB ST 0601 requirements.
ST 0902.3-04	All metadata items contained in the MISMMS shall be reported no less than once every thirty (30) seconds under all circumstances.
ST 0902.8-05	No Zero-Length items (ZLI) shall be used to meet minimum reporting requirements.

Please refer to MISB ST 0601 [1] for further information on each item. Of interest, Tag 48 of MISB ST 0601 contains a nested security Local Set as defined in MISB ST 0102 [4]. Please refer to MISB ST 0102 for further information regarding each security item. MISB ST 0601 also contains reference to a Motion Imagery Core Identifier as defined in MISB ST 1204 [5]. Please refer to MISB ST 1204 for further information regarding the Motion Imagery Core Identifier.

Note 1: Platform Pitch Angle (Tag 6 | 90), Platform Roll Angle (Tag 7 | 91), Sensor True Altitude as MSL (Tag 15) | Sensor Ellipsoid Height as HAE (Tag 75) | Sensor Ellipsoid Height Extended as HAE (Tag 104), Frame Center Elevation as MSL (Tag 25) | Frame Center Height Above Ellipsoid (Tag 78), and Target Width (Tag 22) | Target Width Extended (Tag 96) are governed by an "inclusive or" within MISB ST 0601 with one exception. The use of Tag 75 and Tag 104 is governed by an "exclusive OR."

Note 2: A Motion Imagery Core Identifier (Tag 94) is required as the Motion Imagery data is disseminated from the "system", where the system is the composite of the platform and control station (*i.e.* Ground Control Station).

6.1 Local Set Items

The MISMMS items are listed in Table 1, which has the following column designations:

- **Tag** is the Local Set tag number for the item in the MISMMS.
- **Item Name** is the name of the item.
- **Range & Units** provides the allowed range and unit of specification for the value.
- **Type** indicates the data type of the item.
- **Length** is the number of bytes allowed for the item.

Table 1: Summary of MISMMS Items

Tag	Item Name	Range & Units	Type	Length (Bytes)
1	Checksum	None	uint16	2
2	Precision Time Stamp	Microseconds	uint64	8
3	Mission ID	None	ISO 646	variable
5	Platform Heading Angle	0-360 Degrees	uint16	2
6 | 90	Platform Pitch Angle (Short) Platform Pitch Angle (Full)	+/- 20 Degrees +/- 90 Degrees	int16 int32	2 4
7 | 91	Platform Roll Angle (Short) Platform Roll Angle (Full)	+/- 50 Degrees +/- 90 Degrees	int16 int32	2 4
10	Platform Designation	None	ISO 646	variable
11	Image Source Sensor	None	ISO 646	variable
12	Image Coordinate System	None	ISO 646	variable
13	Sensor Latitude	+/- 90 Degrees	int32	4
14	Sensor Longitude	+/- 180 Degrees	int32	4
15 | 75 | 104	Sensor True Altitude (MSL) Sensor Ellipsoid Height (HAE) Sensor Ellipsoid Height Extended (HAE)	-900 to 19000m -900 to 19000m -900 to 40000m	uint16 uint16 IMAPB	2 2 2
16	Sensor Horizontal FoV	0 to 180 Degrees	uint16	2
17	Sensor Vertical FoV	0 to 180 Degrees	uint16	2
18	Sensor Relative Azimuth Angle	0 to 360 Degrees	uint32	4
19	Sensor Relative Elevation Angle	+/- 180 Degrees	int32	4
20	Sensor Relative Roll Angle	0 to 360 Degrees	uint32	4
21	Slant Range	0 to 5000000 m	uint32	4
22 | 96	Target Width Target Width Extended	0 to 10000 m 0 to 1500000 m	uint16 IMAPB	2 3
23	Frame Center Latitude	+/- 90 Degrees	int32	4
24	Frame Center Longitude	+/- 180 Degrees	int32	4
25 | 78	Frame Center Elevation (MSL) Frame Center Height Above Ellipsoid (HAE)	-900 to 19000 m	uint16	2
48/1	Security Classification	Look Up Table	uint8	1
48/2	Classifying Country & Releasing Instructions Country Coding Method	Look Up Table	uint8	1
48/3	Classifying Country	None	ISO 646	variable
48/4	Security-SCI/SHI Information	None	ISO 646	variable
48/5	Caveats	None	ISO 646	variable
48/6	Releasing Instructions	None	ISO 646	variable
48/12	Object Country Coding Method	Look Up Table	uint8	1
48/13	Object Country Codes	None	UTF-16	variable
48/22	Security Metadata Version	Integer	uint16	2
65	UAS Local Set Version	Integer	uint8	1
94	Motion Imagery Core Identifier	None	binary	50

7 Deprecated Requirements

Requirement -02 was removed as per recent MISB practices where Universal Keys are defined within a dictionary and thus not considered requirements.

Requirement	
ST 0902.3-02 (Deprecated)	The MISMMS shall use MISB ST 0601 [1] Local Set 16-byte Universal Key (06.0E.2B.34.02.0B.01.01.0E.01.03.01.01.00.00.00 (CRC 56773)) for its implementation.

8 Annex A: Recommended MISMMS Item Frequency – Informative

This section addresses the presence and frequency of individual data items within the MISMMS.

Some metadata items change more frequently than others. When sending metadata in bandwidth-constrained environments, it is more efficient to transmit only the dynamic items ("Dynamic") with frequently changing values, and the less dynamic, constant items ("Constant") less often. This section provides guidance in the form of a "*recommended update rate*" for each item of the MISMMS.

Some of the security metadata items may be omitted as they are conditional. Further direction on this topic is found in MISB ST 0102.

Recommendation Summary for MISMMS Frequency (see Table 2):

1. Include Tags 3, 10, 11, 12, 48 sub-tags & 94 once every 10 seconds
2. Include all other items as often as possible, within the available bandwidth and up to the frame rate

The rate at which "Dynamic" items update varies depending on the available bandwidth of the system, and how frequently the metadata values are refreshed. In some systems, it is desirable to have metadata updated for each Motion Imagery frame. For a specific worked example, see Annex B: Example MISMMS Item Rate Calculations – Informative.

Note: It is not mandatory that each metadata packet contain every metadata item; Annex B demonstrates the viability of transmitting the MISMMS in a bandwidth-constrained environment. Given enough bandwidth other metadata packet configurations (*e.g.* more packets each containing fewer items) are permissible.

Table 2: Recommended Update Rate for MISMMS Items

Tag #	Item Name	Max Length (Bytes)	Rec Update Interval
1	Checksum	2	Fast
2	Precision Time Stamp	8	Fast
3	Mission ID	127	10 s
5	Platform Heading Angle	2	Fast
6 |	Platform Pitch Angle (Short)	2	Fast
90	Platform Pitch Angle (Full)	4	Fast
7 |	Platform Roll Angle (Short)	2	Fast
91	Platform Roll Angle (Full)	4	Fast
10	Platform Designation	127	10 s
11	Image Source Sensor	127	10 s
12	Image Coordinate System	127	10 s
13	Sensor Latitude	4	Fast
14	Sensor Longitude	4	Fast
15 |	Sensor True Altitude (MSL)	2	
75 |	Sensor Ellipsoid Height (HAE)	2	Fast
104	Sensor Ellipsoid Height Extended (HAE)	2	
16	Sensor Horizontal FoV	2	Fast
17	Sensor Vertical FoV	2	Fast
18	Sensor Relative Azimuth Angle	4	Fast
19	Sensor Relative Elevation Angle	4	Fast
20	Sensor Relative Roll Angle	4	Fast
21	Slant Range	4	Fast
22 |	Target Width	2	Fast
96	Target Width Extended	3	Fast
23	Frame Center Latitude	4	Fast
24	Frame Center Longitude	4	Fast
25 |	Frame Center Elevation (MSL)	2	Fast
78	Frame Center Height Above Ellipsoid (HAE)	2	
48/1	Security Classification	1	10 s
48/2	Classifying Country & Releasing Instructions Country Coding Method	1	10 s
48/3	Classifying Country	6*	10 s
48/4	Security-SCI/SHI Information	40*	10 s
48/5	Caveats	32*	10 s
48/6	Releasing Instructions	40*	10 s
48/12	Object Country Coding Method	1	10 s
48/13	Object Country Codes	40*	10 s
48/22	Security Metadata Version	2	10 s
65	UAS Local Set Version	1	Fast
94	Motion Imagery Core Identifier	50	10 s
39	Tags	Total	797

Note 3: * indicates the maximum length for these items are only representative for the example in Appendix B as MISB ST 0102 does not define a maximum length.

9 Annex B: Example MISMMS Item Rate Calculations – Informative

This section provides bandwidth budget calculations, assuming a 9600 bits-per-second channel for metadata.

Calculations are presented for two general scenarios:

1. Scenario 1: Assumes all content is always present in each KLV packet
2. Scenario 2: Assumes content is present at variable rates in each KLV packet

9.1 Scenario 1: All Content Always Present

9.1.1 Worst Case

In Table 3 the bandwidth usage for the worst case of this scenario is computed, which includes all tags from Table 2 in every packet.

Table 3: Example bandwidth computation for worst-case usage

	Bytes	Comments
Local Set Key	16	
Local Set Length	2	
Tags	39	Each Tag is 1 byte
Tag's Length	39	Each Length is 1 byte
Tag's Payload	797	See Table 2
Security Set Tag	1	1-byte Tag not shown in table
Security Set Length	2	2 bytes, since Security Set is larger than 127 bytes (per BER-OID)
Total	896	Bytes
Total	7168	Bits
Total with overhead	8960	Serial overhead is 1 Start bit and 1 Stop bit per byte

With serial transmission overhead, 8960 bits will enable one metadata update-per-second at 9600 bits-per-second.

9.1.2 Typical Case

As shown in Table 4, to reduce bandwidth a typical case will limit strings to 20 bytes, eliminate Tags 6, 7, 15, 22, 25 & 75, and reduce the MIIS to 34 bytes.

Table 4: Typical case for Scenario 1

Tag #	Item Name	Length (Bytes)
1	Checksum	2
2	Precision Time Stamp	8
3	Mission ID	20
5	Platform Heading Angle	2
90	Platform Pitch Angle (Full)	4
91	Platform Roll Angle (Full)	4
10	Platform Designation	20
11	Image Source Sensor	20
12	Image Coordinate System	20
13	Sensor Latitude	4
14	Sensor Longitude	4
104	Sensor Ellipsoid Height Extended (HAE)	2
16	Sensor Horizontal FoV	2
17	Sensor Vertical FoV	2
18	Sensor Relative Azimuth Angle	4
19	Sensor Relative Elevation Angle	4
20	Sensor Relative Roll Angle	4
21	Slant Range	4
96	Target Width Extended	3
23	Frame Center Latitude	4
24	Frame Center Longitude	4
78	Frame Center Height Above Ellipsoid (HAE)	2
48/1	Security Classification	1
48/2	Classifying Country & Releasing Instructions Country Coding Method	1
48/3	Classifying Country	6
48/4	Security-SCI/SHI Information	20
48/5	Caveats	20
48/6	Releasing Instructions	20
48/12	Object Country Coding Method	1
48/13	Object Country Codes	20
48/22	Security Metadata Version	2
65	UAS Local Set Version	1
94	Motion Imagery Core Identifier	34
33	Tags	Total 269

Table 5 computes the bandwidth usage for the typical case of this scenario, which includes all tags from Table 4 in every packet.

Table 5: Example bandwidth computation for typical-case usage

	Bytes	Comments
Local Set Key	16	
Local Set Length	2	
Tags	33	Each Tag is 1 byte
Tag's Length	33	Each Length is 1 byte
Tag's Payload	269	See Table 4
Security Set Tag	1	1-byte Tag not shown in table
Security Set Length	1	1 byte, since Security Set is smaller than 128 bytes (per BER-OID)
Total	355	Bytes
Total	2840	Bits
Total with overhead	3550	Serial overhead is 1 Start bit and 1 Stop bit per byte

With serial transmission overhead, 3550 bits will enable two metadata updates per second at 9600 bits per second.

9.2 Scenario 2: Content Present at Variable Rates

When the data rates of individual metadata items are varied, there are more options. One option is to define two different metadata lists: Dynamic and Constant. Dynamic metadata is the subset of metadata where values change frequently -- see items listed as “Fast” in the “Rec Update Interval” column of Table 2. Constant metadata values do not change very often. From these subsets, two KLV sets are used: Dynamic set and Dynamic-plus-Constant. The Dynamic set is transmitted as fast as possible, while the Dynamic-plus-Constant set is only transmitted every 30 seconds to meet the metadata requirements. The Dynamic-plus-Constant set for this example is the same as the Typical Case from Scenario 1, and for this example, will be the “Full-Typical” set. Table 6 lists the items of the Dynamic set for this example scenario.

Table 6: Dynamic-only metadata

Tag #	Item Name	Length (Bytes)
1	Checksum	2
2	Precision Time Stamp	8
5	Platform Heading Angle	2
90	Platform Pitch Angle (Full)	4
91	Platform Roll Angle (Full)	4
13	Sensor Latitude	4
14	Sensor Longitude	4
104	Sensor Ellipsoid Height Extended (HAE)	2
16	Sensor Horizontal FoV	2
17	Sensor Vertical FoV	2
18	Sensor Relative Azimuth Angle	4
19	Sensor Relative Elevation Angle	4
20	Sensor Relative Roll Angle	4
21	Slant Range	4
96	Target Width Extended	3
23	Frame Center Latitude	4
24	Frame Center Longitude	4
78	Frame Center Height Above Ellipsoid (HAE)	2
65	UAS Local Set Version	1
19	Tags	Total 64

Table 7 shows the bandwidth usage computed for the dynamic metadata in this scenario, which includes all tags from Table 6 in every packet.

Table 7: Example bandwidth computation for Dynamic metadata

	Bytes	Comments
Local Set Key	16	
Local Set Length	1	
Tags	19	Each Tag is 1 byte
Tag's Length	19	Each Length is 1 byte
Tag's Payload	64	See Table 2
Total	119	Bytes
Total	952	Bits
Total with overhead	1190	Serial overhead is 1 Start bit and 1 Stop bit per byte

Table 8 shows rate calculations for this scenario when the Full-Typical metadata combine with the dynamic metadata over a 10 second interval.

Table 8: Rate Calculation for Dynamic & Full-Typical Packets

Description	Totals
Bits / 10 s Interval @ 9600 bits per second	96000
1 packet of Full-Typical bits with Serial Overhead	3550
Bits Remaining after Full-Typical Packet	92450
Bits used with Dynamic packet with Serial Overhead	1190
Possible Dynamic Packets / 10 s Interval in Bits Remaining	77.689
Whole Dynamic Packets / 10 s Interval in Bits Remaining	77

That is, in a 10-second interval, it is possible to send one Full-Typical MISMMS packet followed by 77 Dynamic MISMMS packets.

If each packet (Dynamic or Full-Typical) is separated by an equal-sized gap in time, then the rate calculations are as shown in Table 9:

Table 9: Rate Calculation for Dynamic & Full-Typical Packets with Gaps

Description	Totals
Whole Dynamic Packets / 10 s	77
Bits / 10 s @ 9600 bits per second	96000
Bits / 77 Dynamic Packets	91630
Bits / 1 Full-Typical Packet	3550
Bits Remaining	820
# of Gaps	78
Bits / Gap	10.51282
Gap Time @ 9600 bps (microseconds)	1095.085

This packet schedule repeats every 10 seconds (see Figure 1):

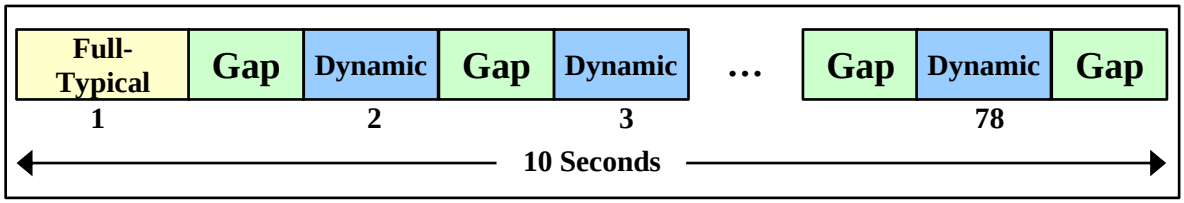


Figure 1: Time Interval with Dynamic Packets and Gaps

10 Annex C: Example MISMMS Data Packets – Informative

This section constructs hypothetical example MISMMS data packets and presents the encoding. All values shown in Table 10 are for illustration purposes only. The Tag-Length-Value (TLV) encoded data are shown as hexadecimal bytes. Programmer's Note: The "Interpretation" of the "Value" is shown in full precision, beyond an item's resolution so programmers can verify they are using the right formulas. The number of significant digits expressed is determined as follows:

1) Based on the dynamic range and the precision needed the number of bits in an integer is determined.
2) The precision, and the maximum value determines the type of value to use (single precision float vice double).

The type of value determines the number of digits (7 to 9 for single, 15 to 17 for double) needed. The use of 9 digits and 17 digits account for any rounding issues in the final digits. The final one or two digits may be different for different complier optimization/hardware.

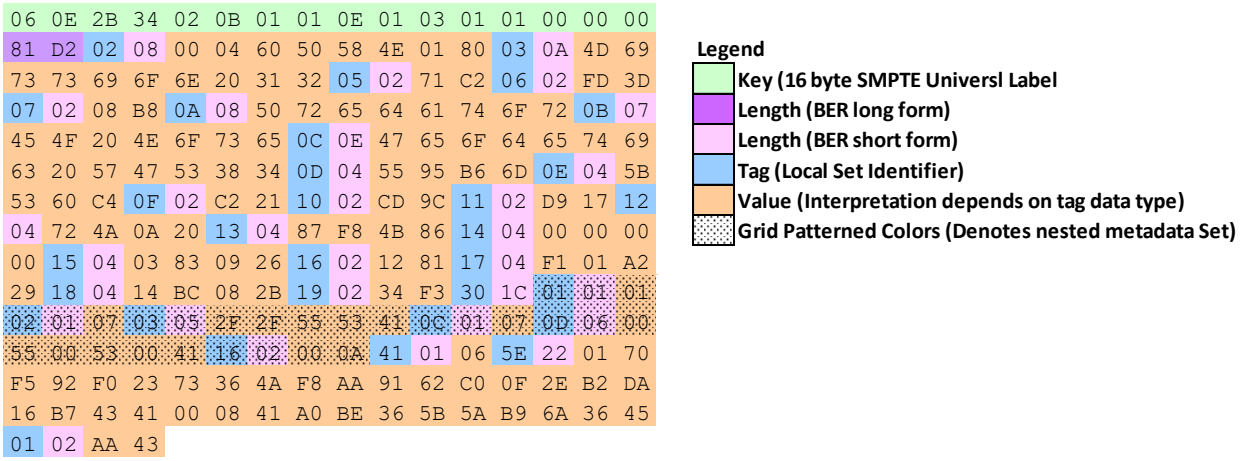
Table 10: Example "Dynamic & Constant" MISMMS Packet Data

Tag #	Item Name	Value	Interpretation	TLV Hex Bytes
2	Precision Time Stamp	1,231,798,102,000,000 microseconds	Mon Jan 12 2009 22:08:22	02 08 00 04 60 50 58 4E 01 80
3	Mission ID	Mission 12	Mission 12	03 0A 4D 69 73 73 69 6F 6E 20 31 32
5	Platform Heading Angle	0x71C2	159.974365 Degrees	05 02 71 C2
6	Platform Pitch Angle (Short)	0xFD3D	-0.431531724 Degrees	06 02 FD 3D
7	Platform Roll Angle (Short)	0x08B8	3.40586566 Degrees	07 02 08 B8
10	Platform Designation	Predator	Predator	0A 08 50 72 65 64 61 74 6F 72
11	Image Source Sensor	EO Nose	EO Nose	0B 07 45 4F 20 4E 6F 73 65
12	Image Coordinate System	Geodetic WGS84	Geodetic WGS84	0C 0E 47 65 6F 64 65 74 69 63 20 57 47 53 38 34
13	Sensor Latitude	0x5595B66D	60.176822966978335 Degrees	0D 04 55 95 B6 6D
14	Sensor Longitude	0x5B5360C4	128.42675904204452 Degrees	0E 04 5B 53 60 C4
15	Sensor True Altitude (MSL)	0xC221	14190.7195 Meters	0F 02 C2 21
16	Sensor Horizontal FoV	0xCD9C	144.571298 Degrees	10 02 CD 9C
17	Sensor Vertical FoV	0xD917	152.643626 Degrees	11 02 D9 17
18	Sensor Rel. Az. Angle	0x724A0A20	160.71921143697557 Degrees	12 04 72 4A 0A 20
19	Sensor Rel. El. Angle	0x87F84B86	-168.79232483394085 Degrees	13 04 87 F8 4B 86
20	Sensor Rel. Roll Angle	0x7DC55ECE	176.86543764939194 Degrees	14 04 7D C5 5E CE
21	Slant Range	0x03830926	68590.983298744770 Meters	15 04 03 83 09 26

22	Target Width	0x1281	722.819867 Meters	16 02 12 81
23	Frame Center Lat.	0xF101A229	-10.542388633146132 Degrees	17 04 F1 01 A2 29
24	Frame Center Lon.	0x14BC082B	29.157890122923014 Degrees	18 04 14 BC 08 2B
25	Frame Center El. (MSL)	0x34F3	3216.03723 Meters	19 02 34 F3
48/1	Security Classification	0x01	UNCLASSIFIED//	01 01 01
48/2	Classifying Country and Releasing Instructions Country Coding Method	0x07	STANAG-1059 Three Letter	02 01 07
48/3	Classifying Country	//USA	//USA	03 05 2F 2F 55 53 41
48/4	Security-SCI/SHI Information	<None>	<None>	
48/5	Caveats	<None>	<None>	
48/6	Releasing Instructions	<None>	<None>	
48/12	Object Country Coding Method	0x07	STANAG-1059 Three Letter	0C 01 07
48/13	Object Country Codes	\u0055\u0053\u0041	USA	0D 06 00 55 00 53 00 41
48/22	Security Metadata Version	10	MISB Standard 0102.10	16 02 00 0A
65	UAS Local Set Version	0x06	MISB Standard 0601.6	41 01 06
94	Motion Imagery Core Identifier			5E 22 01 70 F5 92 F0 23 73 36 4A F8 AA 91 62 C0 0F 2E B2 DA 16 B7 43 41 00 08 41 A0 BE 36 5B 5A B9 6A 36 45
1	Checksum	0xAA43	0xAA43	01 02 AA 43

The TLV bytes are appended end-to-end, and together form the Value portion of the encompassing KLV packet. In the "Dynamic & Constant" packet, there are 210 bytes of TLV data – encoded as the length of the KLV packet. Lengths up to 127 bytes are encoded in BER short form. Lengths of 128 bytes or greater are encoded in BER long form. In this case, 210 bytes are encoded as the BER long form length of 0x81D2.

The Local Set begins with its 16-byte UL key, followed by the length of the data set (0x81D2), which is then followed by the TLV triplets listed above in order. In hex, the complete MISMMS "Dynamic & Constant" example KLV packet is:



The next example, which uses the values in Table 11, illustrates the details of a hypothetical "Dynamic Only" MISMMS data packet. Programmer's Note: The "Interpretation" of the "Value" is shown in full precision, beyond an item's resolution so programmers can verify they are using the right formulas.

Table 11: Example "Dynamic Only" MISMMS Packet Data

Tag #	Item Name	Value	Interpretation	TLV Hex Bytes
2	Precision Time Stamp	1,231,798,102,000,000 microseconds	Mon Jan 12 2009 22:08:22	02 08 00 04 60 50 58 4E 01 80
5	Platform Heading Angle	0x71C2	159.974365 Degrees	05 02 71 C2
6	Platform Pitch Angle (Short)	0xFD3D	-0.431531724 Degrees	06 02 FD 3D
7	Platform Roll Angle (Short)	0x08B8	3.40586566 Degrees	07 02 08 B8
13	Sensor Latitude	0x5595B66D	60.176822966978335 Degrees	0D 04 55 95 B6 6D
14	Sensor Longitude	0x5B5360C4	128.42675904204452 Degrees	0E 04 5B 53 60 C4
15	Sensor True Altitude (MSL)	0xC221	14190.7195 Meters	0F 02 C2 21
16	Sensor Horizontal FoV	0xCD9C	144.571298 Degrees	10 02 CD 9C
17	Sensor Vertical FoV	0xD917	152.643626 Degrees	11 02 D9 17
18	Sensor Rel. Az. Angle	0x724A0A20	160.71921143697557 Degrees	12 04 72 4A 0A 20
19	Sensor Rel. El. Angle	0x87F84B86	-168.79232483394085 Degrees	13 04 87 F8 4B 86
20	Sensor Rel. Roll Angle	0x7DC55ECE	176.86543764939194 Degrees	14 04 7D C5 5E CE
21	Slant Range	0x03830926	68590.983298744770 Meters	15 04 03 83 09 26
22	Target Width	0x1281	722.819867 Meters	16 02 12 81
23	Frame Center Lat.	0xF101A229	-10.542388633146132 Degrees	17 04 F1 01 A2 29
24	Frame Center Lon.	0x14BC082B	29.157890122923014 Degrees	18 04 14 BC 08 2B
25	Frame Center El. (MSL)	0x34F3	3216.03723 Meters	19 02 34 F3

65	UAS Local Set Version	0x06	MISB Standard 0601.6	41 01 06
1	Checksum	0xC850	0xC850	01 02 C8 50

Again, the TLV triplets are appended end-to-end; together they form the Value portion of the encompassing KLV packet. In the "Dynamic Only" packet, there are 97 bytes of TLV data – encoded as the length of the KLV packet. As the length of 97 bytes is less than 128 bytes, it is encoded as the BER short form length of 0x61.

The Local Set begins with its 16-byte UL key, followed by the length 0x61, which is then followed by all the TLV triplets as listed above in order. In hex, the complete MISMMS "Dynamic Only" example KLV packet is:

```
06 0E 2B 34 02 0B 01 01 0E 01 03 01 01 00 00 00
61 02 08 00 04 60 50 58 4E 01 80 05 02 71 C2 06
02 FD 3D 07 02 08 B8 0D 04 55 95 B6 6D 0E 04 5B
53 60 C4 0F 02 C2 21 10 02 CD 9C 11 02 D9 17 12
04 72 4A 0A 20 13 04 87 F8 4B 86 14 04 00 00 00
00 15 04 03 83 09 26 16 02 12 81 17 04 F1 01 A2
29 18 04 14 BC 08 2B 19 02 34 F3 41 01 06 01 02
C8 50
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Legend
- Key (16 byte SMPTE Universl Label
- Length (BER long form)
- Length (BER short form)
- Tag (Local Set Identifier)
- Value (Interpretation depends on tag data type)

11 Annex D: Basis for Metadata Inclusion in MISMMS – Informative

This section provides motivation for the inclusion of each item in the MISMMS. Please note that the metadata items enumerated herein constitute the threshold set to meet two primary ISR missions: Discovery & Retrieval (D&R) and ISR Situational Awareness (ISR SA). The D&R mission refers to storage of Motion Imagery within an archive, and subsequent search and access to the archive. Users needing additional items are encouraged to use other items from MISB ST 0601, or other MISB metadata items as appropriate.

ISR SA as defined in the MISB is "the human perception of the elements of the operational environment in the context of the forces, space, and time, the comprehension of their meaning, and the projection of their status in the near future." SA is subjective; it is perhaps easier to define a SA Product in objective terms.

The MISB defines a SA Product as "a concise, transportable summary of the state of friendly and enemy elements conveyed through information such as Motion Imagery, imagery, or other data that can contribute to the development of SA either locally or at some distant node."

In other words, a SA Product is a collection of those objectives – quantifiable pieces of information that assist someone in the formations of SA for a specific context. In the context of ISR, a SA Product answers three questions regarding an asset: *who* is it, *where* is it, and *what* is it doing?

Items from MISB ST 0601 have been chosen as needed to support the D&R and ISR SA tasks as follows:

Checksum (Tag 1): This item is necessary to ensure the data contained in an instance of a MISB ST 0601 Local Set has not been corrupted during transmission.

Precision Time Stamp (Tag 2): This item is necessary as it indicates the time for which all other items in each MISB ST 0601 Local Set are valid – geospatial information must have a temporal component.

Mission ID (Tag 3): This item is the basis for many D&R queries.

Platform Heading / Platform Pitch / Platform Roll (Tags 5, 6 | 90, 7 | 91): These items define the orientation of an airborne asset, which can be used to predict its future position.

Platform Designation (Tag 10): This item supports both D&R queries and ISR SA regarding the presence of friendly assets.

Image Source Sensor (Tag 11): As some platforms have multiple sensors, information that indicates what sensor is used refines the information included under Platform Designation (Tag 10) for both D&R and ISR SA.

Image Coordinate System (Tag 12): Defines a reference coordinate system for all measurements related to the Earth. It is an essential item for clearly defining measurements such as latitude, longitude, elevation, altitude, etc. fundamental to D&R and ISR SA.

Sensor Latitude / Sensor Longitude / Sensor Altitude (Tags 13, 14, 15 | 75): These items define the position of the active sensor and can be combined with Platform heading / pitch / roll to predict future position of the sensor.

Sensor Field of View-Horizontal / Sensor Field of View-Vertical (Tags 16-17): These two items define the size of the field-of-view of the active sensor. This supports D&R queries related to pixel resolution of the target, and ISR SA by assisting in defining the area of interest for the asset.

Sensor Relative Azimuth Angle / Sensor Relative Elevation Angle / Sensor Relative Roll Angle (Tags 18-20): When combined with Platform heading / pitch / roll, these items comprise the composite pointing vector of the sensor, which is a key component of ISR SA.

Slant Range (Tag 21): While this information can be derived from other information regarding the position & orientation of the platform along with a terrain model, an independent measurement of the slant range to the target (or image center) improves confidence in the position knowledge.

Target Width (Tag 22): This item provides the analyst a quick reference of scale and ground sample distance of a primary object within the viewing area. It is a component of ISR SA.

Frame Center Latitude / Frame Center Longitude / Frame Center Elevation (Tags 23, 24, 25 | 78): These items give the center-point of the imaging sensor (which, when combined with the field-of-view items, define where the sensor is pointing) in support of D&R queries.

Security Classification / Classifying Country & Releasing Instructions Country Coding Method / Classifying Country / SCI-SHI Information / Caveats / Releasing Instructions (Tags 48/1-48/6): Classification information is required by D&R systems to determine appropriate distribution limits. This is a fundamental requirement of all data in the NSG.

Object Country Coding Method / Object Country Code (Tags 48/12-48/13): These items support a fundamental D&R query regarding the country being imaged and support security / releasability decisions.

Security Metadata Version (Tag 48/22): This item ensures proper interpretation of the items that comprise the security Local Set as the standard evolves over time.

UAS Local Set Version (Tag 65): This item ensures proper interpretation of the items that comprise the UAS Datalink Local Set as the standard evolves over time.

Motion Imagery Core Identifier (Tag 94): This item is a unique identifier for sensor data based upon the composite collection system and enables enterprise management of Motion Imagery data.